

PATENT COOPERATION TREATY

PCT

REC'D 10 SEP 2004

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference H0002492 PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US02/15255	International filing date (day/month/year) 10 April 2002 (10.04.2002)	Priority date (day/month/year)
International Patent Classification (IPC) or national classification and IPC IPC(7): H01L 21/316, 21/312; C08J 9/26; C09D 183/04, 183/02 and US Cl.: 427/243, 379, 387		
Applicant HONEYWELL INTERNATIONAL, INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 07 November 2003 (07.11.2003)	Date of completion of this report 23 August 2004 (23.08.2004)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Erma Cameron Telephone No. 571-272-1700 DEBORAH A. THOMAS PARALEGAL SPECIALIST GROUP 1300 <i>del</i>

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US02/15255

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description:
pages 1-30 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

- ☒ the claims:
pages 31-35, as originally filed
pages NONE, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages 36 and 37, filed with the letter of 10 March 2004 (10.03.2004)

- ☐ the drawings:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

- ☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages NONE
- ☒ the claims, Nos. 44 - 46
- ☐ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US02/15255**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. STATEMENT**

Novelty (N)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-43 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest producing a nanoporous silica dielectric film from a silicon precursor, a porogen, and a metal-ion-free catalyst that is either an onium compound or a nucleophile.

Claims 1-43 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

----- NEW CITATIONS -----
NONE

**REPLACED BY
ART 34 AMDT**

31. The method of claim 1 wherein the composition further comprises a solvent having a boiling point ranging from about 50 to about 250 °C.
- 5 32. The method of claim 1 wherein the composition further comprises a solvent selected from the group consisting of hydrocarbons, esters, ethers, ketones, alcohols, amides and combinations thereof.
- 10 33. The method of claim 29 wherein the solvent is selected from the group consisting of di-n-butyl ether, anisole, acetone, 3-pentanone, 2-heptanone, ethyl acetate, n-propyl acetate, n-butyl acetate, 2-propanol, dimethyl acetamide, propylene glycol methyl ether acetate, and combinations thereof.
- 15 34. A nanoporous dielectric film produced on a substrate by the method of claim 1.
35. A semiconductor device comprising a nanoporous dielectric film of claim 34.
- 20 36. The semiconductor device of claim 35 that is an integrated circuit.
37. Porogen that does not bond to a silicon containing pre-polymer and is selected from the group consisting of poly(alkylene) diether, poly(arylene) diether, poly(cyclic glycol) diether, Crown ethers, fully end-capped
25 polyalkylene oxides, fully end-capped polyarylene oxides, polynorbene, and combinations thereof
38. The porogen of claim 37 selected from the group consisting of poly(ethylene glycol) dimethyl ethers, poly(ethylene glycol)
30 bis(carboxymethyl) ethers, poly(ethylene glycol) dibenzoates, poly(ethylene

REPLACED BY
ART 34 AMDT

glycol) diglycidyl ethers, a poly(propylene glycol) dibenzoates,
poly(propylene glycol) diglycidyl ethers, poly(propylene glycol) dimethyl
ether, 15-Crown 5, 18-Crown-6, dibenzo-18-Crown-6, dicyclohexyl-18-
Crown-6, dibenzo-15-Crown-5 and combinations thereof.

5

39. A composition comprising a silicon containing pre-polymer, and a porogen
that does not bond to the silicon containing pre-polymer and is selected from
the group consisting of poly(alkylene) diether, a poly(arylene) diether,
10 poly(cyclic glycol) diether, Crown ethers, polycaprolactone, fully end-capped
polyalkylene oxides, fully end-capped polyarylene oxides, polynorbene, and
combinations thereof.

40. The composition of claim 39 additionally comprising a metal-ion-free
15 catalyst.

41. The composition of claim 40 wherein said metal-ion-free catalyst is
tetramethylammonium acetate.

20 42. The composition of claim 39 wherein said silicon containing pre-polymer
comprises a combination of acetoxy-based leaving groups.

43. The composition of claim 42 wherein said combination of acetoxy-based
leaving groups comprises tetraacetoxysilane and methyltriacetoxysilane.

25

44. A spin-on composition comprising said composition of claim 39.

45. A film comprising said spin-on composition of claim 44.

30 46. In a method of controlling the pore size of a porous silica film, comprising

**REPLACED BY
ART 34 AMDT**

- (a) preparing a composition comprising a silicon containing pre-polymer, a metal-ion-free catalyst selected from the group consisting of onium compounds and nucleophiles; and a porogen;
- (b) coating a substrate with the composition to form a film,
- 5 (c) crosslinking the composition to produce a gelled film, and
- (d) heating the gelled film at a temperature and for a duration effective to remove substantially all of said porogen;
- the method comprising using a porogen which does not bond to the silicon containing pre-polymer.

10